Chapter 3

Stress and Fatigue in Flying Operations

Stress and fatigue in flight operations adversely affect mission execution and aviation safety. Consequently, aircrew members must be familiar with the effects of stress and fatigue on the body and how their behavior and lifestyles may reduce or, alternatively, increase the amount of stress and fatigue that they experience. This chapter reviews aviation stressors and their effects on aircrew-member performance, presents several strategies for coping with stress, and concludes with a discussion of fatigue and its prevention and treatment.

STRESS DEFINED

3-1. Stress is the nonspecific response of the body to any demand placed upon it. About 1926, an Austrian physician, Hans Selye (an endocrinologist), identified what he believed was a consistent pattern of mind-body reactions that he called "the nonspecific response of the body to any demand." He later referred to this pattern as the "rate of wear and tear on the body." In search of a term that best described these concepts, he turned to the physical sciences and borrowed the term "stress."

3-2. Selye's definition is necessarily broad because the notion of stress involves a wide range of human experiences. However, it incorporates two very important basic points: stress is a *physiological* phenomenon involving actual changes in the body's chemistry and function, and stress involves some perceived or actual demand for action. The definition does not qualify these demands as either positive or negative because both types of demands may be stressful. For example, although coming into the zone for promotion to a higher rank is generally considered a positive, potentially rewarding event, the ambiguity and uncertainty of the process are stressful.

IDENTIFYING STRESSORS

3-3. A stressor is any stimulus or event that requires an individual to adjust or adapt in some way—emotionally, physiologically, or behaviorally. Stressors may be psychosocial, environmental, physiological, and cognitive. Before devising an effective stress-management plan, the individual needs to identify the significant stressors in his or her life. The remainder of this section reviews stressors that aircrew members typically encounter.

PSYCHOSOCIAL STRESSORS

3-4. Psychosocial stressors are life events. These stressors may trigger adaptation or change in one's lifestyle, career, and/or interaction with others.

Job Stress

3-5. Work responsibilities can be a significant source of stress for aircrew members. Regardless of job assignment, carrying out assigned duties often produces stress. Conflict in the workplace, low morale and unit cohesion, boredom, fatigue, overtasking, and poorly defined responsibilities are all potentially debilitating job stressors.

3-6. Aircrew members who lack confidence in their ability or who have problems communicating and cooperating with others experience considerable stress.

3-7. Faulty aircraft maintenance also imposes stress on the aviator. Flight crews may not trust those who service their aircraft to perform proper maintenance. As a result, crew members may experience anxiety during flight operations that adversely affects the cohesion and morale of the aviation unit.

Illness

3-8. Although the aviation population undergoes frequent and thorough medical examination, organic disease can occur and should be considered a source of stress. In addition, fatigue is a common symptom of many diseases.

Family Issues

3-9. Although the family can be a source of emotional strength for crew members, it can also cause stress. Family commitments may adversely affect performance, particularly when duty assignments separate crew members from their families. The crew member's concern for family may become a distraction during flight operations or increase fatigue or irritability. The potential dangers of flight operations also act as a stressor on families and may cause tension in spousal relationships. This is particularly the case for the families of new, inexperienced personnel.

ENVIRONMENTAL STRESSORS

Altitude

3-10. The stress caused by altitude is most evident at altitudes below 5,000 feet. This is where the greatest atmospheric changes occur and aircrew members are subject to problems resulting from trapped gas. Even a common cold can cause ear and sinus problems during descent. Because flights seldom exceed an altitude of 18,000 feet, hypoxia and evolved-gas problems, such as the bends, are not significant sources of stress for most Army aviators. Chapter 2 covers the effects of evolved gas, trapped gas, and hypoxia in more detail.

Speed

3-11. Flight is usually associated with speeds greater than those experienced in an everyday, earthbound environment. These speeds are stressful because they require a high degree of alertness and concentration over prolonged periods.

Hot or Cold Environments

3-12. Extreme heat or cold causes stress in the aviation environment. Heat problems may be due to hot, tropic-like climates or to direct sunlight entering through large canopies. Cold problems, on the other hand, may be due to altitude or arctic climates. To lessen temperature stress, crew members need to gradually adapt to the extremes and use proper clothing and equipment.

Aircraft Design

3-13. Human factors engineering items—such as cockpit illumination, instrument location, accessibility of switches and controls, and seat comfort—significantly affect aviator performance. Other influential human factors are the adequacy of heating and ventilating systems, visibility, and noise level. When such items are inadequate or uncomfortable, aircrew members will experience increased stress, which may divert their attention from performing operational duties.

Airframe Characteristics

3-14. The handling and flight characteristics of the airframe are potential stress factors. For example, fixed-wing aircraft have innate stability so that, when trimmed, they can be flown relatively well with minimal pilot attention. Rotary-wing aircraft, however, require constant pilot attention to maintain stability.

Instrument Flight Conditions

3-15. Poor weather resulting in instrument flight conditions imposes significant stress and increases the fatigue of aircrews. Awareness of a greater potential for physical danger and the need for increased vigilance and accuracy in reading, following, and monitoring flight instruments are very stressful. There is a high correlation between adverse weather and accident rates.

3-16. The stress of night flying is similar to the stress of flying in poor weather. Aviators lose their usual visual references and must rely on flight instruments.

PHYSIOLOGICAL (SELF-IMPOSED) STRESSORS

3-17. Although aircrew members often have limited control over many aspects of aviation-related stress, they can exert significant control over self-imposed stress. Many aircrew members engage in maladaptive behaviors that are potentially debilitating and threaten aviation safety. This category can be remembered using the acronym DEATH, which stands for drugs, exhaustion, alcohol, tobacco, and hypoglycemia (Figure 3-1).

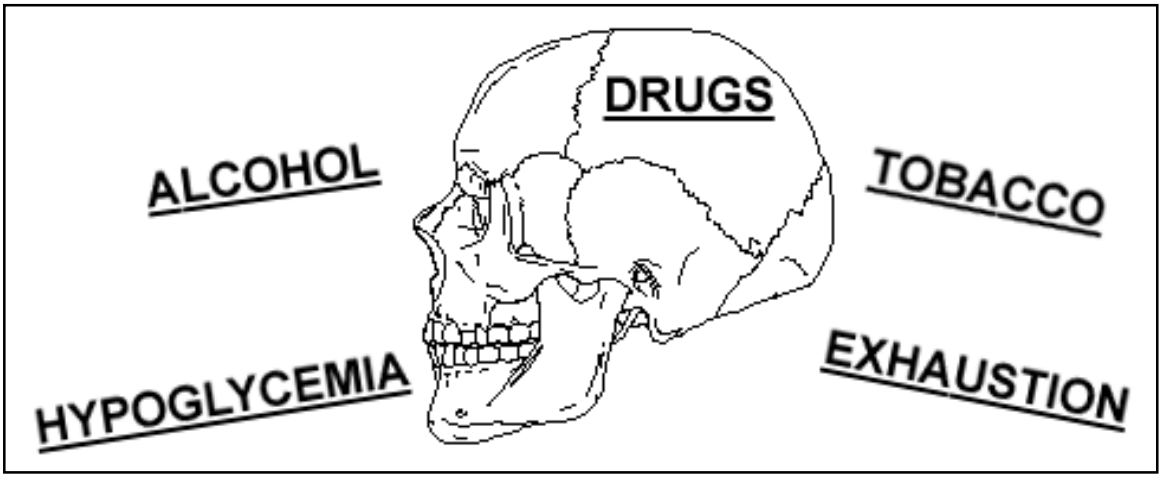

Figure 3-1. DEATH

Drugs

3-18. **Self Medication.** Commercial advertising continually encourages the purchase of nonprescription, over-the-counter medications for a range of minor ailments. The primary purpose of such medications is to *cure a medical problem* or control symptoms of the problem. According to Army regulation, aircrew members must keep the flight surgeon informed of any significant changes in their physical health. Furthermore, most drugs, whether prescribed or over the counter, have unwanted side effects that may vary from person to person. In general, no aircrew member taking medication is fit to fly unless a flight surgeon has specifically cleared the crew member to fly.

3-19. **Predictable Side Effects.** These effects accompany the use of a drug and are incidental to its desired effect. Table 3-1 includes examples of common over-the-counter drugs and their known side effects. These side effects highlight the need for crew members to be aware of known potential problems with drugs. Although crew members may not experience all of the listed side effects, they should know that these might occur.

3-20. **Overdose Problems.** Drugs are to be taken in a given amount over a specified time. The reasoning that "if one pill is good for me, two will be even better" is invalid.

3-21. **Allergic Reactions and Idiosyncrasies.** Some individuals may experience an exaggerated or pathological reaction to a medicine. An example is an allergic reaction to penicillin.

3-22. **Synergistic Effects.** This term refers to undesired effects resulting from the combination of two or more drugs or from a stressful situation experienced while taking a prescribed drug.

Table 3-1. Possible Side Effects of Commonly Used Drugs

Substance	Generic Or Brand Name	Treatment For	Possible Side Effects
Alcohol	Beer Liquor Wine		Impaired judgment and perception Impaired coordination and motor control Reduced reaction time Impaired sensory perception Reduced intellectual functions Reduced tolerance to G-forces Inner-ear disturbance and spatial disorientation (up to 48 hours) Central nervous system depression
Nicotine	Cigars Cigarettes Pipe tobacco Chewing tobacco Snuff		Sinus and respiratory system infection and irritation Impaired night vision Hypertension Carbon monoxide poisoning (from smoking)
Amphetamines	Ritalin Obetrol Eskatrol	Obesity (diet pills) Tiredness	Prolonged wakefulness Nervousness Impaired vision Suppressed appetite Shakiness Excessive sweating Rapid heart rate Sleep disturbance Seriously impaired judgment
Caffeine	Coffee Tea Chocolate No-Doz		Impaired judgment Reduced reaction time Sleep disturbance Increased motor activity and tremors Hypertension Irregular heart rate Rapid heart rate Body dehydration (through increased urine output) Headaches
Antacid	Alka-2 Di-Gel Maalox	Stomach acids	Liberation of carbon dioxide at altitude (distension may cause acute abdominal pain and may mask other medical problems)
Antihistamines	Coricidin Contac Dristan Dimetapp Ornade Chlor-Trimeton	Allergies Colds	Drowsiness and dizziness (sometimes recurring) Visual disturbances (when medications also contain antispasmodic drugs)
Aspirin	Bayer Bufferin Alka-Seltzer	Headaches Fevers Aches Pains	Irregular body temperature Variation in rate and depth of respiration Hypoxia and hyperventilation (two aspirin can contribute to) Nausea, ringing in ears, deafness, diarrhea, and hallucinations when taken in excessive dosages Corrosive action on the stomach lining Gastrointestinal problems Decreased clotting ability of the blood (clotting ability could be the difference between life and death in a survival situation)

Caffeine

3-23. Caffeine is commonly ingested by many people. However, it is a drug with potentially negative effects on flight operations if not used properly and in moderation. Many beverages and foods—such as tea, chocolate, and most cola-type drinks—contain caffeine. Table 3-2 shows the varying amounts of caffeine in these products.

Table 3-2. Caffeine Content of Common Beverages, Foods, and Over-the-Counter Drugs

Product	Amount	Caffeine Content (mg)
Coffee		
Drip	5 oz	146
Perked	5 oz	110
Instant	5 oz	66
Decaffeinated	5 oz	3
Tea		
Five-minute brew	5 oz	46
One-minute brew	5 oz	28
Cola-Type and Pepper-Type Drinks		
Coca-Cola	12 oz	65
Dr. Pepper	12 oz	61
Tab	12 oz	50
Pepsi-Cola	12 oz	43
RC Cola	12 oz	38
Chocolate and Cocoa		
Sweet chocolate bar	1 oz	25
Cocoa	5 oz	13
Over-the-Counter Drugs		
No Doz	1 tablet	200
Dexatrim	1 tablet	200
Excedrin	1 tablet	130
Midol	1 tablet	65
Anacin	1 tablet	64
Dristan	1 tablet	32

3-24. Caffeine is a central nervous system stimulant that counteracts and delays drowsiness and fatigue. Although it increases alertness, the side effects of caffeine may degrade an aircrew member's performance. Caffeine can elevate blood pressure, impair hand-eye coordination and timing, and cause nervousness or irritability. Some people may experience adverse effects when ingesting only 150 to 200 milligrams of caffeine (the equivalent of one or two cups of coffee or several cups of tea). Caffeine is also addictive, and continued use builds tolerance. Over time, people must ingest increasing amounts of caffeine to obtain the same physiological and behavioral effects.

Exhaustion

3-25. **Lack of Rest and Sleep.** Aircrew members require adequate rest and sleep to ensure optimal flight performance. Sleep problems are especially likely during deployments, when the sleep environment may be hot, cold, or noisy. Changes of time zones can also affect sleeping patterns. Crew members should discuss sleeping difficulties with the flight surgeon; inadequate sleep is a potential flight-safety hazard. Changing the work routine or improving the environment may promote sleep and increase operational efficiency.

3-26. **Physical conditioning.** Exercise stimulates the various body systems and has well-documented positive effects on mental health. Lack of exercise impairs circulatory efficiency, reduces endurance, and increases the likelihood of illness. General toning of the muscles, heart, and lungs is essential in preparing aircrews for field exercises and survival situations. Sports that require agility, balance, and endurance are an excellent means of keeping the body and mind in top form.

Alcohol

3-27. Moderate ingestion of alcohol in the form of liquor, wine, or beer is a commonly accepted practice that usually causes no problems. In the aviation environment, however, alcohol can be deadly.

3-28. Ethyl alcohol acts as a depressant and adversely affects normal body functions. Even a small amount has a detrimental effect on judgment, perception, reaction time, impulse control, and coordination.

3-29. Alcohol reduces the ability of the brain cells to use oxygen. Each ounce of alcohol consumed increases the physiological altitude.

3-30. The affects of alcohol on the body and brain depend on three factors:

- The amount of alcohol consumed.
- The rate of absorption from the stomach and small intestine.
- The body's rate of metabolism (which is relatively constant at about 1 ounce every three hours).

3-31. After drinking alcohol, an aviator should wait at least 12 hours before beginning flying duties. Side effects of alcohol are dangerous. If side effects (hangover symptoms) are present, the nonflying period should be extended beyond 12 hours. Taking cold showers, drinking coffee, or breathing 100 percent oxygen does not speed up the body's metabolism of alcohol. Only time will dissipate the effects of alcohol.

3-32. Aircrew members should recognize alcohol as a potential safety hazard and assess their own risk for developing a problem with alcohol. This assessment involves examining the frequency and amount of one's consumption as well as the reasons for consumption. Alcohol should not be a stress-coping strategy.

3-33. Some individuals are more likely to develop an alcohol-abuse problem than are others. For example, people with a family history of alcoholism are at greater risk for developing an alcohol problem than are those without such a history.

3-34. The following four questions will help aircrew members determine if they are misusing or have misused alcohol:

- Have you ever tried to cut back on your alcohol consumption?
- Are you annoyed by comments that people make about your drinking?
- Have you ever felt guilty about your drinking?
- Have you ever had a drink first thing in the morning to get you started?

3-35. Answering "yes" to two or more of these questions may indicate inappropriate alcohol use. Crew members should then more closely examine how frequently, how much, and why they drink alcohol.

Tobacco

3-36. The detrimental effects of tobacco on health are well known. Apart from the long-term association with lung cancer and coronary heart disease, there are other important, but less dramatic, effects. For example, chronic irritation of the lining of the nose and lungs caused by tobacco increases the likelihood of infection in these areas. This is a significant problem for aviators because it affects their ability to cope with the effects of pressure changes in the ears and sinuses. In addition, even a mildly irritating cough causes distress when oxygen equipment is used.

3-37. Although smoking has many long-term effects, such as emphysema and lung cancer, the aviator should be just as concerned about the acute effect of carbon monoxide produced by smoking tobacco. Carbon monoxide combines with hemoglobin to form carboxyhemoglobin. Carbon monoxide attaches to hemoglobin molecules 200 to 300 times more readily than does oxygen. The net effect is a degree of hypoxia. Average cigarette smokers have about 8 to 10 percent CoHb in their blood. This percentage adds about 5,000 feet of physiological altitude. Cigarette smoking also decreases night vision. A nonsmoking pilot begins to experience decreased night vision at 4,000 to 5,000 feet of altitude because of hypoxia; but a smoking pilot begins at sea level with a physiological night-vision deficit of 5,000 feet.

Hypoglycemia

3-38. Aviation medicine experts recognize the importance of a nutritious, well-balanced diet for aircrew members. Nutrition largely depends on individual behavior. When possible, crew members should consume meals at regular intervals. Missing meals or substituting a quick snack and coffee for a balanced meal can induce fatigue and inefficiency. The body requires periodic refueling to function. Normal, regular eating habits are important. Because of mission requirements, aircrew members often disrupt their regular eating habits and skip meals. This disruption can lead to hypoglycemia.

3-39. The liver has a store of energy. This energy is stored in the form of glycogen, a blood sugar. The liver can readily convert this stored form of sugar into glucose that is released to the body to maintain the body's blood-sugar level. Unless food is consumed at regular intervals, the stored glycogen is depleted and a low blood-sugar level, or hypoglycemia, develops.

When the blood-sugar level falls, weakness or fainting occurs and the body's efficiency decreases.

3-40. Insulin lowers the blood-sugar level, but at the same time, blood-sugar is also decreasing through its normal function of fueling the body. These two actions result in a rapid drop in blood sugar that causes further tiredness and inefficiency. It is important to maintain a balanced diet of proper foods that includes proteins, fats, and carbohydrates.

3-41. Aviators must also guard against obesity because of its detrimental effects on general health and performance. Inactivity and boredom during standby duty and long flights can easily lead to overeating. Therefore, it is wise to weigh oneself regularly and adjust the diet to maintain desired weight. This is easier and safer than repeated dieting. In addition, crew members should consult a flight surgeon before beginning a weight-loss dieting regimen. Diet pills are not authorized while on flight status.

COGNITIVE STRESSORS

3-42. How one perceives a given situation or problem is a potentially significant and frequently overlooked source of stress. Pessimism, obsession, failure to focus on the present, and/or low self-confidence can create a self-fulfilling prophecy that will ensure a negative outcome. Below are some typical problems that crew members may encounter in thinking that can increase overall stress.

"Musts and Shoulds"

3-43. Albert Ellis, a renowned clinical psychologist, observed that stress results when individuals believe that things *must* go their way or *should* conform to their own needs and desires or they cannot function. This lack of flexibility in thinking causes problems when reality does not accommodate one's wishes. Failure to accept the possibility that things may happen contrary to one's wishes leaves one unprepared, frustrated, and dysfunctional.

Choice or No Choice

3-44. Healthy individuals believe that there are choices in life. Although certain consequences may make some choices unpalatable, they are choices nonetheless. Experiencing oneself as actively making choices increases one's sense of personal control and decreases stress. Unhappy, unhealthy, and overly stressed individuals often fail to see that they have choices. These people see the world as the cause of their problems.

Failure to Focus on the Here and Now

3-45. Living in the past or the future and overemphasizing what should have been or what could be can increase one's overall stress. Although there is utility in both learning from the past and planning for the future, overengaging in either of these activities can cause people to fail at tasks and miss opportunities in the present.

THE STRESS RESPONSE

3-46. Stress affects individuals in a variety of ways. These effects may include emotional, behavioral, cognitive (thoughts), and physical responses.

EMOTIONAL RESPONSES

3-47. Emotional responses to stress may range from increased anxiety, irritability, or hostility to depressed mood, loss of self-esteem, hopelessness, and an inability to enjoy life. If emotional responses are severe and interfere significantly with social or occupational functioning, crew members should consult the flight surgeon. Aviators and other aviation personnel often shy away from seeking help for emotional problems, but it is important to recognize that stress can become overwhelming at times and present a serious threat to aviation safety.

BEHAVIORAL RESPONSES

3-48. High stress can adversely affect one's work performance, decrease motivation, and increase the likelihood of conflict, insubordination, and violence in the workplace. Some individuals may become socially isolated. Others may abuse drugs or alcohol as an ineffective stress-coping strategy. Suicidal thoughts and intent may also occur in individuals under high stress. The following are danger signals for suicide risk:

- Talking or hinting about suicide.
- Having a specific plan to commit suicide and the means to accomplish it.
- Obsession with death.
- Giving away possessions or making a will.
- A history of prior suicide attempts.
- Multiple, recent life stressors.
- Alcohol consumption, which increases the risk of following through on suicidal thoughts.

3-49. Crew members should always take these danger signals seriously. Individuals exhibiting some or all of these signals should be approached supportively and referred to a mental-health provider for evaluation. The flight surgeon should be contacted to make an appropriate referral to a mental-health provider.

COGNITIVE RESPONSES

3-50. Stress can significantly affect one's thought processes. It can decrease attention and concentration, interfere with judgment and problem solving, and impair memory. Stress can cause aviators to commit thinking errors and to take mental shortcuts that could be potentially fatal.

The Simplification Heuristic

3-51. Under high-stress conditions, people tend to oversimplify problem solving and ignore important relevant information, taking the easy way out.

For example, an aviator experiencing high stress before going into combat may, in haste, fail to follow all of the steps of the preflight inspection.

Stress-Related Regression

3-52. Many individuals under high-stress conditions will forget learned procedures and skills and revert to bad habits. For example, a student aviator preparing for takeoff may forget to turn on the fuel switch and then, realizing the problem and feeling stressed and embarrassed, turn the switch on and risk overheating the engine. This action is clearly contrary to his training and represents a kind of regression or failure to use prior learning.

Perceptual Tunneling

3-53. This is a phenomenon in which an individual or an entire crew under high stress becomes focused on one stimulus, like a flashing warning signal, and neglects to attend to other important tasks/information such as flying the aircraft. A similar situation may occur when an aviator realizes during flight that he or she overlooked some aspect of flight such as missing a radio communication. The stressed aviator may then overattend to rectifying this problem/become emotionally and mentally fixated on the error and fall "behind the aircraft," missing new information and further compromising the mission.

PHYSICAL RESPONSES

3-54. The immediate physical response to a stressful situation involves overall heightened arousal of the body. The response may include increased heart rate, increased blood pressure, more rapid breathing, tensing of the muscles, and the release of sugars and fats into circulation to provide fuel for "fight or flight."

3-55. Prolonged stress and its continuous effects on the body may produce longer-term physical symptoms such as muscle tension and pain, headaches, high blood pressure, gastrointestinal problems, and decreased immunity to infectious diseases.

STRESS UNDERLOAD

3-56. Having too little stress in one's life may be as dysfunctional as having too much stress. A lack of challenges can lead to complacency, boredom, and impulsive risk taking. Individuals should strive to balance the stress in their lives to be optimally challenged without overwhelming their coping resources. The effects of stress underload are of particular concern in peacekeeping operations. In such operations, soldiers will often have a considerable amount of unstructured time and work tasks can become routine and monotonous. Thus, leaders need to minimize unstructured time as much as possible, using it, instead, as an opportunity for skills training, cross-training, and physical training and other activities that challenge and develop subordinates.

STRESS AND PERFORMANCE

3-57. The relationship between stress and performance depends on a variety of factors. These factors will be discussed in the following paragraphs.

MENTAL SKILLS REQUIRED BY THE TASK OR SITUATION

3-58. The degree to which a given task or situation requires specific cognitive skills—such as attention, concentration, memory, problem solving, or visual-spatial orientation—will influence the extent to which stress will degrade performance. Performance in situations involving simple mental tasks tends to be less affected by stress than performance in situations that require more complex cognitive skills. For example, writing a letter under high stress would probably result in fewer errors than taking a written exam under high stress.

STRESS CHARACTERISTICS OF THE SITUATION

3-59. The degree to which stress affects performance also depends on the environment and conditions under which a given task is performed. For example, taking a stressful, timed problem-solving test in a quiet, comfortable room is much easier and will result in fewer errors than taking the same test in a hot, noisy room.

PHYSICAL CHARACTERISTICS OF THE INDIVIDUAL

3-60. Individual differences in strength, endurance, and physical health greatly influence the extent to which stress affects performance. This is especially true in aviation operations in which aircrew members must be in top physical condition to perform in the physically challenging conditions of continuous operations and combat.

PSYCHOLOGICAL MAKEUP OF THE INDIVIDUAL

3-61. Mental health, much like physical health, serves to moderate the effects of stress on performance. Individuals with good coping, problem-solving, and social skills will perform much better under stress than those who are weaker in these areas.

STRESS MANAGEMENT

3-62. Stress-coping mechanisms are psychological and behavioral strategies for managing the external and internal demands imposed by stressors. Coping mechanisms can be characterized according to the following categories.

AVOIDING STRESSORS

3-63. This is the most powerful coping mechanism. Crew members can avoid stressors with good planning, foresight, realistic training, good time management, and effective problem solving. Staying physically fit and eating right are also effective strategies for avoiding fatigue, illness, and related stressors. Good crew coordination and communication—including asking questions, using three-way confirm responses, and briefing lost communication—also serve to avoid flight stress.

CHANGING YOUR THINKING

3-64. As indicated in the earlier discussion on cognitive stressors, how you perceive your environment and choose to think about yourself and others greatly affect your stress level and performance. Crew members may greatly enhance their stress management and personal effectiveness by—

- Practicing positive self-talk.
- Taking responsibility for their actions.
- Recognizing the choices that they make.
- Avoiding perfectionism and inflexibility in thinking.
- Focusing on the here and now rather than on the past or future.

LEARNING TO RELAX

3-65. Relaxation is incompatible with stress. It is impossible to be relaxed and anxious at the same time. Learning and regularly practicing relaxation techniques, breathing exercises, or meditation or regularly engaging in a quiet hobby greatly reduce stress. Although this recommendation may sound simplistic, few people actually practice relaxation regularly. Making time to relax during a busy schedule is perhaps the biggest obstacle to this coping strategy.

VENTILATING STRESS

3-66. This strategy involves "blowing off steam" in some manner, either through talking or vigorous exercise. Talking out problems may be accomplished informally, with friends or family, or professionally, with a mental-health practitioner or chaplain. Exercise should be a regular part of everyone's lifestyle; it is effective in both preventing and coping with stress problems. Volumes of research have documented the positive benefits of exercise for both physical and mental health.

FATIGUE

3-67. Fatigue is the state of feeling tired, weary, or sleepy that results from prolonged mental or physical work, extended periods of anxiety, exposure to harsh environments, or loss of sleep. Boring or monotonous tasks may increase fatigue.

3-68. As with many other physiological problems, crew members may not be aware of fatigue until they make serious errors. Sleep deprivation, disrupted diurnal cycles, or life-event stress may all produce fatigue and concurrent performance decrements. The types of fatigue are acute, chronic, and motivational exhaustion, or burnout.

ACUTE FATIGUE

3-69. Acute fatigue is associated with physical or mental activity between two regular sleep periods. The loss of both coordination and awareness of errors is the first type of fatigue to develop. Crew members feel this tiredness, for example, at night after being awake for 12 to 15 hours in a day. With

adequate rest or sleep, typically after one regular sleep period, the aircrew member will overcome this fatigue. Acute fatigue is characterized by—

- Inattention.
- Distractibility.
- Errors in timing.
- Neglect of secondary tasks.
- Loss of accuracy and control.
- Lack of awareness of error accumulation.
- Irritability.

Mental deficits like those listed above are apparent to others before the individual notices any physical signs of fatigue.

CHRONIC FATIGUE

3-70. This much more serious type of fatigue occurs over a longer period and is typically the result of inadequate recovery from successive periods of acute fatigue. Besides physical tiredness, mental tiredness also develops. It may take several weeks of rest to completely eliminate chronic fatigue; and there may be underlying social causes, such as family or financial difficulties, that must be addressed before any amount of rest will help the person recover. The crew member or unit commander must identify chronic fatigue early and initiate a referral to the flight surgeon for evaluation and treatment. Chronic fatigue is characterized by some or all of the following characteristics:

- Insomnia.
- Depressed mood.
- Irritability.
- Weight loss.
- Poor judgment.
- Loss of appetite.
- Slowed reaction time.
- Poor motivation and performance on the job.

MOTIVATIONAL EXHAUSTION OR BURNOUT

3-71. If chronic fatigue proceeds untreated for too long, the individual will eventually “shut down” and cease functioning occupationally and socially. Motivational exhaustion is also known as burnout.

EFFECTS OF FATIGUE ON PERFORMANCE

REACTION-TIME CHANGES

3-72. Fatigue can result in either increases or decreases in reaction time. Increases occur because of the general decrease in motivation and sluggishness that often accompany fatigue. Decreases in reaction time may also occur, however, when individuals become impulsive and react quickly and poorly.

REDUCED ATTENTION

3-73. Aircrew members may exhibit the following signs/symptoms of reduced attention:

- Tendency to overlook or misplace sequential task elements (for example, forgetting items on preflight checklists).
- Preoccupation with single tasks or elements—for example, paying too much attention to a bird and forgetting to fly the aircraft (the cause of many accidents).
- Reduction of audiovisual scan both inside and outside of the cockpit.
- Lack of awareness of poor performance.

DIMINISHED MEMORY

3-74. Aircrew members may be experiencing diminished memory when they display the following characteristics:

- Short-term memory and processing capacity decrease although long-term memory tends to be well preserved during fatigue. Integrating new information and making decisions becomes more challenging, as does adaptability to change in general.
- Inaccurate recall of operational events (for example, forgetting the location of the objective rally point).
- Neglect of peripheral tasks (for example, forgetting to check if the landing gear is down).
- Tendency to revert to old bad habits.
- Decreased ability to integrate new information and analyze and solve problems.

CHANGES IN MOOD AND SOCIAL INTERACTION

3-75. Fatigued individuals may become irritable and combative. They may also experience mild depression and withdraw socially.

IMPAIRED COMMUNICATION

3-76. Fatigue impairs one's ability to both communicate and receive information. Individuals may leave out important details in the messages that they send to others. They may also fail to attend completely to information that they receive, or they may misinterpret the information. Fatigue can also affect a crew member's pronunciation, rate of speech, tone, or volume.

DIURNAL (CIRCADIAN) RHYTHMS AND FATIGUE

3-77. We have an intrinsic biological clock with a cycle of roughly 24 to 25 hours, and many important bodily functions such as core body temperature, alertness, heart rate, and sleep cycle occur along these diurnal rhythms. In the typical circadian cycle, performance, alertness, and body temperature—

- Peak between 0800 and 1200 hours.
- Drop off slightly between 1300 and 1500.

- Begin to increase again from 1500 to 2100.
- Drop off again and fall to a minimum circadian trough between 0300 and 0600 hours.

3-78. While the body clock can monitor the passage of time, it differs from most clocks in that it is flexible and must be set, or synchronized, before it can accurately predict the timing of events. External synchronizers or Zeitgebers (a German word that means "time givers") are—

- Sunrise/sunset.
- Ambient temperature.
- Meals/social cues.

CIRCADIAN DESYNCHRONIZATION (JET LAG)

3-79. Rapid travel from one time zone to another causes the body to resynchronize its diurnal rhythms to the local geophysical and social time cues. Until intrinsic rhythms are reset, sleep disorders and fatigue will prevail. Traveling eastward shortens the day; westward travel lengthens the day. Consequently, resynchronization occurs much more rapidly when traveling west. Shift work can have effects similar to crossing time zones because of the changes in light exposure and activity times.

THE SLEEP CYCLE

3-80. Sleep is not simply being unconscious. It is a life-essential active process. The sleeping brain cycles between rapid eye movement and non-REM sleep through five stages. The cycling occurs every 90 minutes. In eight hours of sleep, one normally attains five to six REM stages.

3-81. The duration and quality of sleep depend on body temperature. People sleep longer and report a better night's sleep when they retire near the temperature trough.

3-82. As indicated above in the section on diurnal rhythms, it is the timing of sleep, not necessarily the amount of sleep, that is most significant. A sleep schedule that is inconsistent with one's circadian rhythm and the light and social cues of the environment will ultimately result in fatigue. Frequent changes in one's sleep schedule may also result in fatigue.

3-83. Sleep efficiency deteriorates with age. Older individuals spend less time in deep non-REM sleep. Nighttime awakenings and daytime sleepiness result.

SLEEP REQUIREMENTS

3-84. Individuals cannot accurately determine their own impairment from sleep loss. During operations in which sleep loss is expected, aircrew members should closely monitor each other's behavior for indicators of fatigue such as those identified in paragraphs 3-73 through 3-77.

3-85. The average person sleeps seven to nine hours per day. Sleep length can be reduced one to two hours without performance decrement over an

extended period. Once the period ends, however, individuals must return to their normal sleep length.

3-86. As a rule, five hours of sleep per night are the minimum for continuous operations (for example, for 14 days). However, some individuals may tolerate as little as four hours per night for short periods (up to one week).

3-87. Sleep-restriction decisions and crew-endurance planning should consider—

- Complexity of the job tasks to be performed under conditions of fatigue.
- Potential for loss from errors committed because of fatigue.
- The individual's tolerance of sleep loss.

PREVENTION OF FATIGUE

3-88. Total prevention of fatigue is impossible, but its effects can be significantly moderated. The following recommendations should be considered in any individual- or crew-endurance plan.

CONTROL THE SLEEP ENVIRONMENT

3-89. The sleep environment should be cool, dark, and quiet. It is also best to avoid working or reading in bed; this may actually contribute to problems in falling asleep. The bed should be associated only with sleeping and sexual activity. If you desire to read before going to bed, do this in a chair, preferably in a room other than your bedroom, and then go to bed.

ADJUST TO SHIFT WORK

3-90. The following measures will help aircrew members adjust to shift work and prevent circadian desynchronization:

- Maintain a consistent sleep-wake schedule even on days off.
- When on the night shift, avoid exposure to daylight from dawn to 1000. Wear sunglasses if you cannot go to sleep before the sun rises (as long as this does not pose a safety hazard). Consider wearing a sleep mask while sleeping to avoid any exposure to light.
- You may eat a light snack before going to sleep. Do not go to sleep too full or too hungry.
- Avoid caffeine consumption for six hours before going to sleep.

MAINTAIN GOOD HEALTH AND PHYSICAL FITNESS

3-91. Aircrew members can maintain good physical fitness with regular strenuous exercise. Elimination of tobacco use also promotes good health and physical fitness.

PRACTICE GOOD EATING HABITS

3-92. It is important to maintain a balanced diet of proper foods that includes proteins, fats, and carbohydrates. Failing to give the body the quality fuel that it needs will contribute to the aircrew member's fatigue and poor work performance.

PRACTICE MODERATE, CONTROLLED USE OF ALCOHOL AND CAFFEINE

3-93. Use of alcohol as a sleep aid can interfere with REM sleep and disrupt sleep patterns. Frequent use of caffeine often contributes to insomnia.

PLAN AND PRACTICE GOOD TIME MANAGEMENT

3-94. Plan and practice good time management to avoid last-minute crises. A reasonable, realistic work schedule will assist greatly in preventing fatigue.

PRACTICE REALISTIC PLANNING

3-95. Practice realistic planning for total duty and flying hours as outlined in AR 95-1. Studies have shown that the relative fatigue factor of a flight hour varies with the type of flight environment that the aviator encounters (for example, chemical MOPP flight is more fatiguing than day NOE flight).

MAINTAIN OPTIMAL WORKING CONDITIONS

3-96. Particular attention should be devoted to addressing problems associated with the following factors:

- Glare.
- Vibration.
- Noise levels.
- Poor ventilation.
- Temperature extremes.
- Uncomfortable seating.
- Inadequate oxygen supply.
- Instrument and control location.
- Anthropometry (body measurements).

TAKE NAPS

3-97. When sleep is not available or is shortened by operational concerns, naps are a viable alternative. In general, longer naps are more beneficial than short naps, but even naps as short as 10 minutes can increase one's energy level. Longer naps (greater than one hour) may result in a period of sluggishness (sleep inertia) for 5 to 20 minutes after awakening. Therefore, longer naps are better than shorter naps. Therefore, when deciding how long to nap, one should consider what work requirements would be present upon awakening from the nap. The best time to nap is when body temperature is low (around 0300 and 1300).

Note: If you are having problems sleeping during your normal sleep period, *do not* take naps during the rest of the day because napping may delay sleep onset during your regular sleep period.

TREATMENT OF FATIGUE

3-98. The most important action for treating fatigue is to get rest and *natural* (not drug-induced) sleep. Alcohol is the number-one sleep aid in the United

States, but it suppresses REM sleep, as mentioned above. Correcting bad sleep habits is one type of treatment for fatigue.

3-100. If you find yourself lying awake in bed for more than 30 minutes, get out of bed and read a boring book or listen to some relaxing music until you are ready to fall asleep. Lying in bed awake can produce a mental association between being in bed and anxiety/wakefulness, which will promote insomnia. If you return to bed and remain awake for more than 30 minutes, get up again. Continue to do this as much as needed during the night. Eventually, fatigue will take over and you will sleep.

3-101. When attempting to recover from 24 to 48 hours of sleep deprivation, do not sleep longer than 10 hours. Sleeping for too long may further disrupt the sleep-wake schedule and cause sluggishness during the day.

3-102. There are other measures that can be taken to prevent or treat fatigue:

- Modify the workplace to promote rest and prevent any further fatigue.
- Rotate duties to avoid boredom, or change duties.
- Pace yourself, and avoid heavily task-loaded activities, those requiring short-term memory, or those demanding prolonged or intense mental activity.
- Limit work periods, and delegate responsibility. If possible, suspend activity during periods when fatigue is higher and efficiency is lower; for example, between 1300 and 1500 hours.
- Use brief periods of physical exercise immediately before task performance, particularly administrative work. However, do not exercise closer than one hour before bedtime; exercising may delay the onset of sleep.
- Remove yourself from flying duties when fatigue affects flight safety.